

# A Survey On Mobile Cloud Computing

Ayush Agrawal<sup>1</sup>, Devesh Katiyar<sup>2</sup>, Gaurav Goel<sup>3</sup>

<sup>1</sup>MCA Student, Department of Computer Science, Dr. Shakuntala Misra National Rehabilitation University, Lucknow, India

<sup>2,3</sup>Assistant Professor, Faculty of Computer & Information Technology, Dr. Shakuntala Misra National Rehabilitation University, Lucknow, India

\*\*\*

**Abstract** - Mobile cloud computing is the accessibility of cloud computing services in a mobile atmosphere. It provides optimal services for mobile users. Mobile Cloud Computing combines the features of mobile networks and cloud computing together. In mobile cloud computing, all the data and complex computing modules can be managed in mobile and cloud devices and doesn't require any powerful configuration like CPU speed, memory capacity, Fast Processing etc. Though, the mobile devices are facing up with many Problems in their resources (e.g., storage, bandwidth and battery life) and communications (e.g., mobility, security and privacy). These Issues have great affect in the enhancement of service qualities. In this paper, we discussed on the overview of mobile cloud computing technology with the architecture, applications, security issues, advantage and limitation and possibly solution.

**Key Words**- Mobile Cloud Computing (MCC), Mobile environment, Mobile networks.

## 1. INTRODUCTION

Nowadays, the market of mobile phones is increasing at a very high speed. Everyone has a mobile phone which has the features to move anyplace and access the data anytime. There are some boundaries in mobile phones as compared to the desktop/laptops these are limited storage capacity, bandwidth, battery life etc. With the development of Cloud computing in mobile users can utilise the infrastructure, platform and software provided by cloud providers on on-usage basis. Development of Cloud Computing along with the mobile devices gave existence to Mobile Cloud Computing.

Mobile Cloud Computing belongs to an infrastructure where processing of data and storage can happen external to the mobile device. Mobile device does not require any large storage capacity and powerful processing speed. All the data will be processed outside the mobile devices on any integrated computing platform located on cloud server. According to research by the year 2011 the number of mobile users across the world will be 5.8 billion.

Due to major useable model in the time of Internet, mobile cloud computing has developed a significant research topic of the scientific and industrial peoples. Its usage is becoming more demanding day by day. Therefore, different type of applications based on MCC have been settled and provided to users, Like Google's Maps, Voice Search and Navigation systems for Mobile phones,

Gmail, and various applications on an Android/IOS platform. The main reason behind the cloud computing is the faster delivery of different types of services, increasing storage, reducing cost, powering systems and decoupling of service delivery from core technology, and providing flexibility and mobility of data in different purposes. Mobile cloud applications change the processing power and storage of data from mobile phones and into the cloud server. Aeron describes mobile cloud computing as a latest model for mobile applications where data processing and data storage are shifted from mobile device to dominant and centralized computing platforms located on clouds via internet. All these type of integrated applications are then used via wireless connection built on a thin native client or web browser on the mobile devices.

## 2. MOBILE CLOUD COMPUTING ARCHITECTURE

The general architecture of Mobile Cloud Computing can be seen in Figure 1. The core architecture of MCC includes the components: internet service providers, mobile users, cloud service providers, mobile operators, respectively.

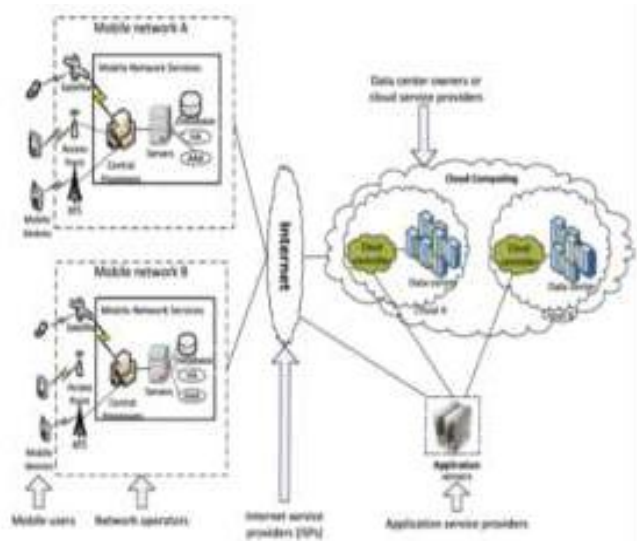


Figure-1: Architecture of Mobile Cloud Computing

The Mobile devices consist of mobile phones which communicates with the mobile networks with the use of respective stations, access points and satellite. The information's are communicated from the mobile devices and this information are functioned on the CPU unit, servers and database on the mobile network provider server. In this, mobile network operators can provide respected services to mobile phone users as an authorization, authentication based on the home agent and subscriber's data stored in the databases. After that, the users request to the cloud via internet and cloud server process the requests to route towards corresponding cloud services to provide mobile user. The mobile cloud computing architecture gives efficiency by using the features of the cloud computing. Four deployment models are used for cloud architectures are:

### 2.1 Private Cloud

This type of cloud computing architecture is used by a private institute or organization and may be managed by the organization or a third party. It can exist within or outside the organization.

### 2.2 Community Cloud

Various institutions take the cloud infrastructure which supports a various community and it must have some shared concern such as security issues, policy, vision and conformism considerations. Different organizations or third party may take care of community cloud and it can exist on physical server or can be hosted by any Organization.

### 2.3 Public Cloud

This type of cloud infrastructure is accessible to the overall public or any large industry group. It may be maintained by an organization selling the cloud services.

### 2.4 Hybrid Cloud

This type of cloud architecture is a combination of two or more clouds services that remain distinctive, but are joined together any standardized technology. The specific clarifications of clouds architecture could be diverse in diverse contexts. Hence, four-layer architecture is explained to equate cloud computing with grid computing. It describes architecture for creating market-oriented clouds services and use this architecture for web distributed business services.

## 3. APPLICATIONS OF MOBILE CLOUD COMPUTING

Mobile cloud computing has a huge number of application in several fields and a large range of potential mobile cloud applications have been discovered in the present works. Mobile cloud computing can be used in execution of mobile accounting, mobile payment or in mobile pharmacy. It is also used for listening music anytime from anywhere in the world. Some of the applications of MCC are mentioned here.

### 3.1 Cloud email:

Nowadays all mobile users are using Gmail (a Cost free service given by Google) on user's mobile devices. Therefore, Gmail is an exact example of Mobile cloud computing because all the emails of a user are stored on a cloud server and tasks are accomplished on the cloud.

### 3.2 Mobile commerce

Mobile commerce applications are like mobile shopping, accounting, advertising, finance etc. All these type of applications require flexibility like mobile ticketing, mobile transactions, payments, etc. There are Various Challenges of using Mobile Commerce like low network bandwidth, privacy, security etc. but the development of Cloud Computing reduces these challenges.

### 3.3 Cloud music:

Providing Features of listening Music Anywhere to users on their mobile device is a perfect instance where Mobile cloud computing is implemented.

### 3.4 Mobile gaming

Mobile Cloud Computing offers the facility of game playing on mobile devices. Mobile gaming needs large figuring resources but with help of Mobile Computing all processes are performed on clouds server. So mobile devices do not need require high processing resources. The idea of unloading is used in mobile gaming.

### 3.5 Voice-based searching

In This user can find everything without typing it via speech recognition. The AT & T speech mashup method that involve web service with mobile computing environment is used to accomplish the demand of speech recognition.

## 4. MOBILE CLOUD COMPUTING CHARACTERISTIC

The major characteristics of mobile clouds computing are described below:

### 4.1 Flexibility/Elasticity

Users are free to access any computing resources without the help of human interactions. The abilities of users can be quickly and elastically increased, in some situations vigorously.

### 4.2 Scalability of Infrastructure

The new node can be added or dropped from the network with very least changes in the infrastructure in the physical servers to set up the software. According to need mobile cloud architecture can scale high or low easily.

### 4.3 Broad Network Access

User experiences and facilities are present on the network and can be retrieved through standard procedure that promote use of varied platforms like phones, PDA, laptops, iPad and mobile etc.

### 4.4 Location Independence

Location individuality is an additional characteristic of MCC. There is a sense of different location individuality. In this the customer doesn't have the control over the location from where the resource is provided. But it may be able to require location at a advanced level of abstraction from country data centre.

### 4.5 Reliability

With the usage of multiple redundant site reliability can be enhanced and this makes cloud computing more

effective for various recovery applications and business strategies.

### 4.6 Economies of Scale and Cost Effectiveness

For the usage of benefit of economies of scale mobile cloud applications, irrespective of the deployment procedure, is supposed to be as large as possible. Huge quantity of mobile cloud deployments is placed near to inexpensive power stations and cheap real estate, for lowering the costs.

## 5. ISSUES AND APPROACHES FOR MOBILE CLOUD COMPUTING

MCC is like wedding between two technologies named mobile web and Cloud computing. So there is an strong connection between these two. As the mobile has the limit to solve the computations but the cloud has very powerful computations to solve any issues as compare to mobile. So there are various problems in applying cloud computing for mobile. These problems are kind of like limited security, related to network, limitation of resources in mobile users and clouds. Various problems are clarified in this paper as follows:

### 5.1 Limited Resources

Having very less amount of resources in mobile device makes difficult of using the services of cloud. Here are two simple limitations related to less resources available. which are as follows:

#### 5.1.1 Power of Computation is limited

As compared to desktop computers the speed of processors is slow in mobile devices. For increasing the speed of processor in mobile higher power consumption needed.

So there is a requirement to make the stability between battery power and processor speed. The first solution can be performing all computations on servers but in many cases it is not good to perform computations on server side. Then also there are many difficulties related to security, privacy and reliability will occur.

#### 5.1.2 Limited Battery

The main barrier for the mobile devices for connecting via wireless network is the limited amount of battery in mobile devices. Hence it consumes high amount of battery consumption. Therefore, a procedure is used to ensure storage integrity for MCC. This planned procedure makes an incremental cryptography for dynamic data structures, and also minimizes energy usage.

## 5.2 Network Related Issues

All the process in Mobile Computing is achieved on the network. Hence there are some problems associated to the network like heterogeneity, Bandwidth, availability, latency.

### 5.2.1 Latency and Bandwidth

Latency is interruption in data processing on the network. As latency depends on network so it is a problem in MCC. Mobile Cloud is also affected by Bandwidth. Having small tower signal gives low bandwidth and great latency in the network.

Wi-Fi is an example which decreases bandwidth but it improves latency. The use of 4G will help to increase the bandwidth and latency. The use of Cloudlets also helps to increase this issue. Cloudlet is a trustworthy collection of computers which present near the user and connected through internet. So if the condition of offload, delay, cost etc. arises on cloud then user can use cloudlet. It copies user data from a integrated location to authorize mobile users to access the data and thus decrease latency. When the services are used by user then data can go back to the originated location. So need of mobile users for communicating in real time retort by low-latency, and high-bandwidth wireless access to the cloudlet can see. The user can also use the default mode if there is no cloudlet are available at that time and hence send all the required data to the distant cloud.

### 5.2.2 Availability

The main problem in MCC is Network availability. It needs a mobile device to always be linked with internet to access cloud computing which is not easy due to absence of mobile service analysis or internet connectivity.

Wi-Fi is one way out to offer good and fast network access even then also when mobile device does not have network coverage or Wi-Fi on their zone. This difficulty of network availability is beneath research work.

## 5.3 Security

Maximum number of mobile devices have nearly same features like a desktop computer. So mobile devices also have to be go through a number of problems associated to security and privacy. To solve this problem Threat

Detection Services are now executed at clouds but this also has lots of drawbacks. Some security concerns are as follows:

### 5.3.1 Security of Users and Mobile Devices

There are lots of security problems like viruses, hacking, Trojan horses in mobile devices or desktop. Access of global positioning system (GPS) in mobile devices causes the problem of privacy issues.

- (i) **Device Security:** Mobile devices are easily stooled by someone or misplaced as compared to desktop computers. So there is always a risk related to data privacy because all data is kept on the cloud somewhere unfamiliar to user various security issues like malware, Trojan, worms, hacking are done with the use of mobile devices. Latest smart phones getting in the market have different security applications to exclude fraud usage of mobile.
- (ii) **Privacy of mobile user:** Currently many mobile users are accessing Location based services (LBS). LBS have a big problem related to privacy of user because it offers the data of the user about current location. This issue becomes very massive if confidential data of user is disclosed to any untrusted individual. Location Trusted Server (LTS) has solved this problem. LTS is shown in fig.2. When a user wants to access Location based service, it will give its location to Location Trusted Server (LTS). Now it is task of LTS to not show user data by 'Spatial Cloaking'. When cloaked region is created, LTS transferred spatial cloaking to LBS providers. Then after LBS Service provider processed the and queries send back these query outcomes to LTS which will transfer final result to user.

### 5.3.2 Securing Data on Cloud

All the information of mobile user is kept on the cloud hence authentication, integrity and confidentiality of data becomes a major problem. The information of each user can be reformed by any untrusted person so all the task should be performed in careful manner. Various clarifications have been given for security and integrity of data on cloud and many are beneath research work.



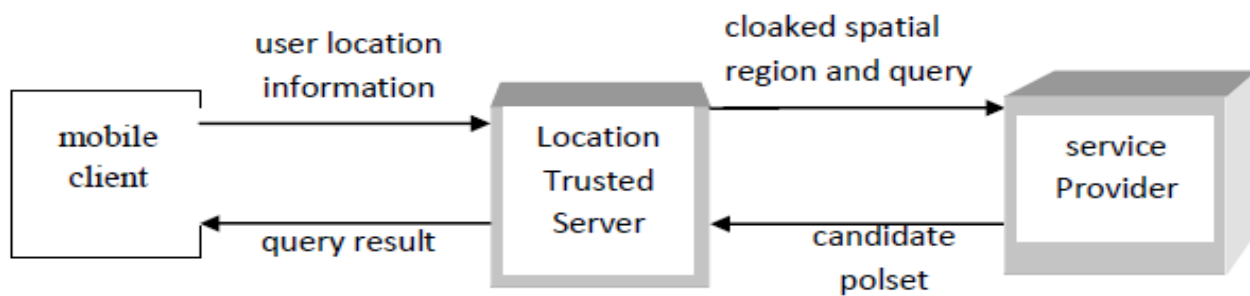


Figure-2: Overall Architecture of Spatial

## 6. FUTURE RESEARCH WORK

We have perceived many problems related to MCC and various issues architectures to explain these issues. Therefore, still there are many different types of problems being there in MCC and different type of research developments can also be done on Mobile Computing. There are Some concerns like Mobile devices has restricted storage and processing speed. Various operating systems are accessible for mobile devices like IOS, Android, Symbian etc. So task related to these common access platforms for mobile cloud computing is conceivable on best of these different operating system platform can be done. In future the research related to security and integrity can be done because there are various issues on security threats both inside and outside the cloud server. Different architectures models of MCC can be reconnoitred. Also cost policy is essential to be enhanced with development of MCC. Things related to access schemes can be improved in future. Low bandwidth of network is a main issue in which enhancement can be performed because quantity of mobile and cloud users is growing regularly. Research associated to Quality of Service should also be improved to provide better quality of requesting facilities to the users.

## 7. CONCLUSION

The major objective behind the Mobile Cloud Computing is to encourage the mobile user by giving them a continuous and rich functionality, irrespective of limitation of resources on mobile devices. However still now it is on the initial stage of development, in future MCC could become main model for mobile applications. According to a recent study, more than 241 million businesses access cloud services via mobile devices by 2016 and will drive the profits of mobile cloud computing to \$8.2 billion. On the basis of this importance, this paper has given a survey on Mobile Cloud Computing in which its definitions, architecture, issues, approaches are present. We have provided a wide

survey on existing mobile cloud computing research in this paper. Hence we have highlights the major objectives of mobile cloud computing and also described various definitions of mobile cloud computing in this literature.

## REFERENCES

- [1] Sarah Perez, August 4, 2009, Why cloud computing is the future of mobile, [http://www.readwriteweb.com/archives/why\\_cloud\\_computing\\_is\\_the\\_future\\_of\\_mobile.php](http://www.readwriteweb.com/archives/why_cloud_computing_is_the_future_of_mobile.php).
- [2] Tavel, P. 2007. Modeling and Simulation Design. AK Peters Ltd.
- [3] Hasib Zaman, Praveen Dandu, Wutao Wei "Implementation Issues of Mobile Cloud Computing"
- [4] Chetan S, Gautam kumar, K. Dinesh, Mathew K. and Abimanyu M.A "Cloud computing for mobile world" national institute of technology,calicut
- [5] Security First: Security and data protection in Google data centers <http://googleenterprise.blogspot.com/2011/04/security-first-security-and-data.html>
- [6] Chang, J., Balan, R. K., & Satyanarayanan, M. 2005. Exploiting rich mobile environments, 2005
- [7] Foster, I., Zhao, Y., Raicu, I., & Lu, S. 2008. Cloud computing and grid computing 360-degree compared. In Grid Computing Environments Workshop, 2008.
- [8] ABI Research <http://www.abiresearch.com>
- [9] [http://www.tutorialspoint.com/cloud\\_computing/cloud\\_computing\\_mobile.htm](http://www.tutorialspoint.com/cloud_computing/cloud_computing_mobile.htm)
- [10] Kanchan Patil, Sandip Patil; A case study on mobile cloud computing.